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ABSTRACT

The classroom test performance of three groups, self-monitoring (SM), a combination of self-monitoring, self-reinforcement and self-punishment (SM+C), and controls, were compared in independent replications in a chemistry (n=149) and a calculus (n=80) class. In chemistry, but not calculus, the experimental subjects outperformed controls. It was predicted that SM+C would outperform SM students and would also report more study time, but these hypotheses were not confirmed. Reported study time differed between the two classes and the course difficulty level also appeared to differ. Course difficulty may be affecting the successful use of self-control techniques. (Author)

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Effects of Self-Monitoring and a Combination of Self-Monitoring, Self-Reinforcement, and Self-Punishment of Study Time on Test Performance

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Effects of Self-Monitoring and a Combination of Self-Monitoring, Self-Reinforcement, and Self-Punishment of Study Time on Test Performance

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The present investigation compared self-monitoring (SM), with a combination of techniques consisting of self-monitoring, self-reinforcement and self-punishment (SM+C), and controls in two separate experiments. Classroom test performance was the dependent variable of primary interest.

Literature Review

Of the studies which examined the effect of self-control techniques on the academic performance of college students, most findings indicate study behaviors can be modified by self-control techniques. Richards (1975) found that college students' study behaviors were significantly modified by self-control techniques and that self-monitoring was an effective addition to study skills advice. His treatment consisted of monitoring daily the number of pages read and hours studied. Weekly record sheets were required as well as a cumulative graph for the five-week treatment time. Self-monitoring groups increased their study time significantly during the experimental period.

Johnson and White (1971) reported that self-monitoring study behavior increased academic performance when college

students were asked to observe, record, and graph their study activities using a point system for different activities. Course grades as of the sixth week were significantly higher for these students relative to students asked to monitor dating behavior and relative to a control group that did not monitor any behavior. Significant differences were not obtained for final course grade, however.

Mahoney, Moore, Wade, and Moura (1973) reported a more refined comparison of the effects of two types of self-monitoring on academic performance. They found continuous self-monitoring to be more effective than intermittent self-monitoring with reference to the length of time college students spent in review efforts for the Graduate Record Examination. They also found that self-monitoring affected accuracy on sample problems differentially, enhancing accuracy on mathematical problems dramatically but demonstrating no effect on verbal accuracy.

Unsuccessful applications of self-monitoring have also been reported. Bristol and Sloane (1974) compared the test performance of college students assigned to three groups: a control group, a second group that recorded and graphed study time, and a third group that participated in contingency contracting of study time using monetary reinforcement. No significant differences were found on test performance among the three groups.

Miller and Gimpl (1971) also reported unsuccessful results with self-monitoring in their comparison of self-

monitoring, self-instruction, and external reinforcement, where the external reinforcement consisted of points earned toward a psychology course grade. The external reinforcement group increased study time most, and self-monitoring was least effective in this study.

The effects of information feedback, self-reinforcement and self-monitoring of study behavior were investigated by Richards, McReynolds, Holt, and Sexton (1976). Volunteer college students concerned about study habits were assigned to a study skills advice group, six study skills/self-monitoring groups, and a control condition. The self-monitoring study skills groups were superior to study skills advice which was superior to controls in the examination performance.

Richards et al. (1976) collapsed the experimental groups into two categories: informed and uninformed. Uninformed students were those whose baseline estimates of study time were most discrepant from the times reported during the first week of the experiment. They found those students who had previously over-estimated their study time substantially increased their actual time to the level of informed students over the experimental period. The authors conclude that "behaviorally uninformed students derived more benefit from self-monitoring than informed students" (p. 318).

Similarly, McReynolds and Church (1973) compared the Work Methods and Study Habits scores on the survey of Study Habits and Attitudes (SSHA) for 39 college student volunteers

who met the requirement of a low grade point average and a reduced load. The authors reported significantly higher Work Methods and Study Habits scores for students in a study skills class and in a self-contracting group utilizing self-monitoring, self-reinforcement and self-contracts, relative to controls. Significant gains in grade points were made by these two groups, but not in grade point average.

On the whole, self-monitoring effects are evident and the addition of reinforcement has increased the effect in some cases. Self-reinforcement techniques have been shown to be equal in effectiveness to external reinforcement in the general self-control literature. However, only two studies compared these techniques using college students and academic performance. Speidel (1974) found contingent self-reward and experimenter reward in the form of television viewing to be equally effective and more effective relative to controls in increasing the number of arithmetic problems completed by college students. Jackson and Van Zoost (1972) assigned 47 and 35 college students in two experiments to one of four conditions: self-administered reinforcement, external reinforcement, no reinforcement, and no treatment control. The three reinforcement conditions varied by the way in which students could earn back a required $10 deposit. The authors reported that no significant difference in grade point average was obtained in either experiment, however

SSHA Work Methods scores did improve significantly for external and self-administered reinforcement groups.

In a study using a combination of self-control techniques, Beneke and Harris (1972) taught a self-control procedure for modifying study behavior to college students which consisted of stimulus control procedures, self-reinforcement and punishment, and a study method, the SQ3R, outlined by Robinson (1970). Two instructional formats were used: written instruction and group discussion. The combination of techniques resulted in a significant gain in grade point average for three semesters following the program, in comparison with two semesters prior to the program, for both experimental groups relative to controls.

It is apparent that the studies of the effectiveness of self-monitoring, self-reinforcement, and self-punishment in improving college academic performance are inconclusive. The self-monitoring effects appear to be better demonstrated, however, in general, these studies are not designed to isolate the effect of self-monitoring.

The present study was designed to provide information on the relative effectiveness of self-monitoring (SM) and a combination of self-monitoring, self-reinforcement and self-punishment (SM+C). Jeffrey (1974) writes:

> . . . a feasible strategy to isolate the effects of self-monitoring is to use an experimental design that separates the relative contribution of self-monitoring from other aspects of the

> treatment. A between-subjects group design with a no-treatment control group, a self-monitoring group only and a self-monitoring plus some-treatment group could be used to isolate the relative effectiveness of self-monitoring to behavior changes. (p. 183)

This is the same comparison Thoreson and Mahoney called for (1974) and precisely the comparison which was employed in the present investigation.

Method

Hypotheses

Three hypotheses were investigated in this study:

Hypothesis 1: Students in the experimental conditions (SM and SM+C) will demonstrate superior test performance relative to controls.

Hypothesis 2: Students in the SM+C condition will demonstrate higher test performance than students in the SM conditions.

Hypothesis 3: Students in the SM+C condition will report higher mean study time compared to students in the SM condition.

Design

The study included three conditions: self-monitoring (SM), self-monitoring plus a combination of self-reinforcement and self-punishment (SM+C), and control (C). The same design was used in two different classes constituting two identical independent experiments.

Dependent Variables

The primary dependent variable was the second midterm examination. In addition, daily reported study time was

obtained from subjects in the two experimental conditions as a result of the presence of the independent variable requiring self-monitoring. It was not available for controls. Finally, a questionnaire was administered to subjects in the two experimental conditions to obtain feedback on the experiment and to assess the subjects' degree of conformity to instructions.

Subjects

The subjects were 299 students in two classes--an introductory chemistry class, and a second-quarter calculus class. In total, 232 students participated out of 299 for a 77.6% overall participation rate. Three of the 232 students were excluded from the data analysis because they were missing a score on the first midterm examination which served as a covariate. Additional covariates which were recorded were Scholastic Aptitude Test (SAT) Verbal and Quantitative aptitude scores as well as evaluated high school grade point average. In chemistry, the subjects were 56% male and 43% female, and, in calculus, they were 52% male and 47% female. The subjects in both classes were approximately 70% freshmen and 20% sophomores.

Materials

Cover letter. A standard cover letter was used for all three experimental conditions in which the students were asked not to discuss the project, given an overview of the project, and assured of anonymity. The cover letter was used, also, to inform students that each week they returned their data sheets, a token would be placed in a large jar and they would

earn a chance on a $50 prize. In order to be eligible for the drawing, the student must have participated for all three weeks of the project. An addendum to the cover letter was added indicating that a 90% return rate for the entire class was essential to the project's success. If the return rate was not high enough, the drawing would be held in another class spring quarter when the project was repeated. This addendum was added to encourage participation, although a 90% participation rate was not actually essential or expected.

Instruction sheet. The instruction sheet constituted page two of the packet and it existed in three forms. Instructions to students in the SM condition specified that they were to log and graph on a daily basis the amount of study time they spent each day on their class, excluding time in class. A sample of a week's log and graph was included. In the SM+C condition students received identical instructions. Additionally, they were to record a self-rating of the amount of time spent on the class. They were to record a plus (+) whenever they regarded the amount of time to be adequate and a minus (-) when it was inadequate. This self-rating was to be based on their own opinion of adequate study time. Students in the control condition were given a task irrelevant to the present investigation. They were asked to describe in a few sentences nonclassroom experiences they judged to be equal to or greater in importance with their course work.

Report forms. Report forms existed in three formats as well. They had in common a small token in the lower right-hand corner that contained the student's code number. In addition to the student's code number, the report form number (1, 2, 3), and, the due date were written at the top of the form. The SM form consisted of a blank graph with seven days of the week on the abscissa and 250 minutes or six hours on the ordinate. A row of seven boxes under the days of the week was used for logging daily study time in minutes. The SM+C form was identical to the form above with the addition of seven boxes for self-ratings. The control form was blank except for the identifying information and the token. Three copies of the appropriate report form were included in each packet.

Questionniare. Two forms of the questionnaire were utilized. Control subjects did not receive questionnaires. The 13-item SM questionnaire included nine items designed to assess the degree to which the subjects in the condition reported that they adhered to the instructions. In addition, three items asked whether the student thought the project had an effect on study time, whether he/she would continue graphing study time for this class, and whether he/she would use graphing in other classes. The 13th question was open-ended and sought feedback on the project. The SM+C questionnaire contained four additional items intended to assess conformity to condition with regard to self-rating. All other items were identical to the self-monitoring questionnaire previously described. Ques-

tionnaires were distributed on the last day of the project to the students in the two experimental conditions.

Procedures

In a two-minute class announcement, the experimenter outlined the information in the cover letter and highlighted the $50 drawing. Class rosters were used to randomly assign students to one of the three conditions. Students received their designated materials at the time of their first midterm examination.

During the experimental period, the experimenter wrote announcements on the chalkboard at every class session. Announcements included the beginning date and due date of the week's project, compliments on excellent participation rate, and during the final week, an announcement about the $50 drawing date. After each collection date, a telephone follow-up was conducted the following day for all students who did not turn in a form. Students were generally appreciative of the phone reminder. Students without phones received notes in the mail within 24 hours.

The third and final collection was made on the day of the class's second exam when, in addition to collecting project #3, questionnaires were distributed to students in the two experimental conditions.

The $50 drawing was conducted in both classes one week after the second examination. One token was drawn in each class, the student's name was read from the log of code numbers, and a $50 check was given to the student.

Results

Academic Performance

Analysis of covariance was used to analyze the scores obtained on the primary dependent variable, the second midterm. The first midterm was used as the covariate. In the chemistry class, the correlation for midterm I and the dependent variable was .660, the multiple R^2 was .435, and F (1, 145) = 11.63, $p < .0001$. In Experiment 2, midterm I and the dependent variable correlated .618, with a multiple R^2 of .381, and F (1, 76) = 46.86, $p < .0001$. SAT scores and evaluated high school grade point average (gpa) were not included as covariates in the final analysis because they did not add significantly to the variance accounted for by the use of midterm I alone.

Two orthogonal contrasts were examined in each class. The contrast associated with Hypothesis 1 is a comparison of the test performance of students in the two experimental conditions combined (SM and SM+C) with that of the controls. The contrast associated with Hypothesis 2 compared the test performance of students in the two experimental conditions. Table 1 includes the estimates of the contrasts and associated standard errors. It is important to note that the contrast for Hypothesis 1 considered the control group first and the contrast for Hypothesis 2 considered the SM+C condition first to give meaning to the signs of the contrasts.

Table 1

Least Squares Estimate of the Contrast and Standard Error by Hypothesis and Experiment

	Chemistry			Calculus		
	Contrast	s.e.	n	Contrast	s.e.	n
Hypothesis 1	-4.59	2.30	149	1.97	3.52	80
Hypothesis 2	-2.61	2.72	98	3.29	4.11	53

Chemistry. It was predicted in Hypothesis 1 that students in the two experimental conditions (SM and SM+C) would demonstrate superior test performance relative to controls, replicating earlier findings that the use of self-control techniques enhanced academic performance. A significant difference was obtained for midterm II when students' test performance in the experimental conditions was compared with that of the controls, F (1, 145) = 3.85, $p < .052$, using the adjusted means from the ANCOVA. Thus, the test scores for the experimental conditions were 4.59 points higher on the average when compared with controls.

With regard to Hypothesis 2, it was predicted that students assigned to the SM+C condition, requiring both self-monitoring and self-rating, would evidence higher test performance than students in the SM condition who simply monitored their study time. No significant difference was obtained for midterm II when students in the two experimental conditions were compared, F (1, 145) = .928, $p < .337$, using adjusted means. Students' performance in the SM condition averaged only about 2.6 points

higher than that of students in the SM+C condition. The direction of the effect is opposite of that predicted although it is not significant. Table 2 includes the adjusted and observed means for the three conditions.

Table 2

Adjusted and Observed Midterm II Mean Scores in Chemistry by Condition

	Control		SM+C		SM	
	$\bar{X}$	n	$\bar{X}$	n	$\bar{X}$	n
Adjusted	70.59	51	73.88	52	76.49	46
Observed	71.25		75.42		74.28	
Observed s.d.	17.21		17.83		17.85	

Calculus. Neither Hypothesis 1 nor Hypothesis 2 was supported in the calculus class. With regard to Hypothesis 1, no significant difference was obtained when self-control conditions (SM and SM+C) were compared with controls, F (1, 76) = .346, $p < .558$, using adjusted means. As for Hypothesis 2, no significant difference was obtained on midterm II in a comparison of the two experimental conditions, F (1, 76) = .642, $p < .425$, using adjusted means. In calculus, the use of these specific self-control techniques did not enhance performance. Table 3 includes the adjusted and observed means for the three conditions.

Reported Study Time

It was predicted in Hypothesis 3 that students in the SM+C condition would report a higher mean study time compared

Table 3

Adjusted and Observed Midterm II Mean Scores in Calculus by Condition

	Control		SM+C		SM	
	$\bar{X}$	n	$\bar{X}$	n	$\bar{X}$	n
Adjusted	73.23	27	72.90	25	69.61	28
Observed	75.15		69.96		70.64	
Observed s.d.	18.97		19.97		17.09	

with students in the SM condition. Significant differences between experimental conditions were not obtained in either the chemistry or the calculus class when the average study time for the three-week experimental period was compared. Table 4 contains the average daily reported study time for each of the three weeks. The average daily reported study time is presented in Table 5 by condition and course for the entire experimental period.

Four initial observations may be made from the tables. As is apparent in Table 4, reported study time steadily increased over the three-week period. In chemistry, students averaged about 42 minutes a day during the first week and increased to about 2.5 hours a day during the third week. In calculus the increase was smaller. Students reported daily study time of approximately 17 minutes during the first week and 37 minutes during the third week. Thus, a second observation is that reported study time increased much more in the chemistry class when compared with calculus students' reports.

Table 4

Average Daily Reported Study Time in Minutes by Week, Condition, and Course

Week		Experiment 1			Experiment 2		
		Chemistry[a]			Calculus		
		SM	SM+C	Total	SM	SM+C	Total
1	$\bar{X}$	42.28	41.82	42.03	17.14	17.34	17.24
		(32.13)[b]	(33.26)	(32.57)	(14.58)	(15.47)	(14.86)
2	$\bar{X}$	64.26	55.59	59.66	22.41	25.96	24.09
		(46.87)	(50.67)	(48.87)	(18.46)	(19.63)	(18.92)
3	$\bar{X}$	155.35	147.10	150.97	37.14	37.02	37.08
		(78.66)	(76.73)	(77.35)	(28.54)	(25.12)	(26.72)

Note. The n's are as follows: Chemistry, SM = 46, SM+C = 52, Total = 98; Calculus, SM = 28, SM+C = 25, Total = 53.

[a]Daily study time was not reported on the 20th and 21st days in chemistry, hence, the weekly average for the third week is based on data from 5 days.

[b]Standard deviations are enclosed in parentheses.

Table 5

Average Daily Reported Study Time in Minutes over the Three-Week Experimental Period by Condition and Course

	SM	SM+C	Total
Chemistry[a]	80.13 (41.02)	74.60 (37.69)	77.20 (39.18)
Calculus	25.57 (17.67)	26.77 (16.68)	26.14 (17.06)

Note. The n's are as follows: chemistry, SM = 46, SM+C = 52, total = 98; calculus, SM = 28, SM+C = 25, total = 53.

[a]Average for the experimental period is 19 days instead of 21.

Third, students in chemistry reported much higher average study time over the entire experimental period (Tables 4 and 5). A fourth and final observation is that both daily and weekly averages were associated with high variability. The standard deviations for average daily study time were often larger than the value of the daily average.

An additional multivariate repeated measures analysis of variance was performed on the reported study time data to address the following questions: Was there an experimental condition by time interaction? Was there a significant difference between the two experimental conditions in the amount of study time reported? Was there a significant difference in time reported over the three-week period?

In the chemistry class, the interaction between experimental condition and time was not significant, multivariate

F (2,95) = .471, $p < .626$. Thus, the pattern of study time reported did not vary differentially between the two conditions. Furthermore, there was no significant difference between the two experimental conditions with regard to the study time reported over the three-week period, F (1, 96) = .47, $p < .492$. However, with regard to the third question, there was a significant difference in the amount of study time reported over the three-week period, multivariate F (2, 95) = 96.10, $p < .0001$. That is, there was a significant increase in the amount of time chemistry students reported studying over the three-week period.

Associated with the above procedures one can fit a polynomial model to the data points. The step down F for testing the fit of a higher order equation was 1.12, $p < .292$, which is not significant. The step-down F for a linear equation was 190.84, $p < .0001$, indicating that the best fit was a linear model.

In the calculus class, the results were similar. The interaction between experimental condition and time was not significant, multivariate F (2, 50) = .31, $p < .732$. In addition, there was no significant difference between the two experimental conditions with regard to reported study time over the three-week period, F (1, 51) = .07, $p < .800$. However, a significant difference was obtained in the amount of study time reported over the three week-period, multivariate F (2, 50) = 21.69, $p < .0001$. The best fitting model was,

once again, linear with a step-down F of 43.16, $p < .0001$; whereas, the test for a higher order equation was not significant, step-down F of .59, $p < .451$. Figure 1 portrays the average weekly study time for the combined experimental conditions, SM and SM+C.

Self-Rating of Study Time

Students recorded either a plus (+) or a minus (-) when they rated their daily study time. Positive ratings were coded as 2's and negative ratings were coded as 1's; hence, the midpoint of the range is 1.5. Average scores that are above 1.5 indicate an overall positive assessment of the day or week's study time. Conversely, scores below a 1.5 indicate a negative assessment. Table 6 contains the average daily rating of study time for each of the three weeks. Table 7 contains the average rating of study time for each day in the experimental period.

Table 6

Weekly Average Rating of Daily Study Time in Condition 2, SM+C, by Course

Week	Experiment 1 Chemistry[a]		Experiment 2 Calculus	
	$\bar{X}$	s	$\bar{X}$	s
1	1.39	(0.25)	1.59	(0.27)
2	1.41	(0.25)	1.40	(0.29)
3	1.63	(0.28)	1.53	(0.24)

Note. In chemistry, $n = 52$; in calculus, $n = 25$.

[a]Ratings were not obtained for the 20th and 21st days in chemistry.

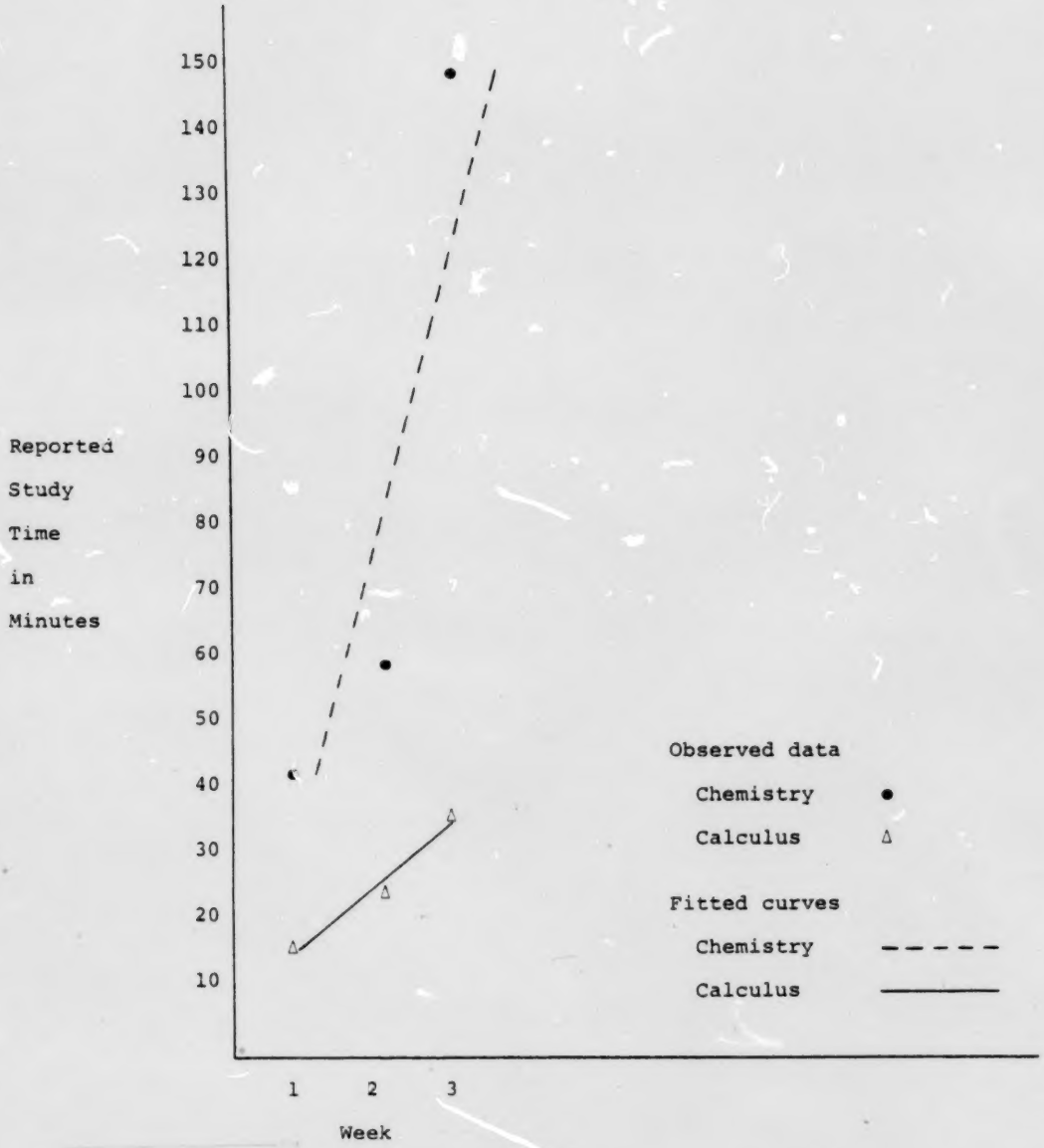

Figure 1. Reported study time by week and course for combined SM and SM+C conditions.

Table 7

Average Rating of Daily Study Time in Condition 2, SM+C, by Course

Day		Experiment 1		Experiment 2	
		Chemistry[a]		Calculus	
		$\bar{X}$	s	$\bar{X}$	s
1	(M)	1.44	0.50	1.84	0.35
2	(T)	1.48	0.51	1.48	0.51
3	(W)	1.42	0.50	1.60	0.50
4	(T)	1.37	0.49	1.64	0.49
5	(F)	1.40	0.50	1.52	0.51
6	(S)	1.17	0.38	1.56	0.51
7	(S)	1.44	0.50	1.48	0.51
8	(M)	1.48	0.51	1.36	0.49
9	(T)	1.39	0.49	1.40	0.50
10	(W)	1.44	0.50	1.36	0.49
11	(T)	1.48	0.51	1.48	0.51
12	(F)	1.35	0.41	1.36	0.49
13	(S)	1.33	0.47	1.44	0.51
14	(S)	1.42	0.50	1.40	0.50
15	(M)	1.48	0.51	1.40	0.50
16	(T)	1.54	0.50	1.60	0.50
17	(W)	1.75	0.44	1.52	0.51
18	(T)	1.64	0.49	1.40	0.50
19	(F)	1.75	0.44	1.64	0.49
20	(S)	-	-	1.56	0.51
21	(S)	-	-	1.60	0.50

Note. In chemistry, n = 52; in calculus, n = 25. Values that are underlined are positive ratings.

[a]In chemistry midterm II was held at the end of the 19th day, hence ratings were not obtained for the 20th and 21st days.

Two observations can be made from these tables. First, chemistry students tended to rate their study time negatively. On only five of 19 days (26%) did students in chemistry give themselves a positive rating. Four of these five days were during the third week when study time was averaging 2.5 hours a day. In calculus, positive ratings were given for 10 of 21 days (48%). These ratings were included in the first week when reported study time was a low average of 17 minutes daily, and, during the third week when reported study time had increased to 37 minutes daily. A second observation is that the self-ratings differed between the two classes. Calculus students consistently rated their study time more positively despite the fact that their reported time was considerably lower than that reported in chemistry.

Questionnaire Responses

The questionnaire distributed to all subjects in both experimental conditions at the time of the second class midterm had two sections: conformity to instructions and student opinion. In preparing for the analysis of questionnaire data, questions on the 12-item SM condition questionnaire were renumbered so that identical questions also had identical item numbers for data processing and data display purposes. This is portrayed in Table 8. Items 6, 8, 9, and 11 were not included in the questionnaire received by subjects in the SM condition.

As is evident in Table 8, students typically conformed to instructions. The means and standard deviations for items 1-13

Table 8

Average Score on Questionnaire Items by Course and Conditions

Questionnaire Items		Experiment 1			Experiment 2		
		Chemistry			Calculus		
		SM	SM+C	Total	SM	SM+C	Total
1. Each day I recorded the amount of time I studied for this class.	$\bar{X}$	3.13 (0.69)[a]	3.35 (0.68)	3.25 (0.69)	3.32 (0.72)	3.32 (0.63)	3.32 (0.67)
2. In addition, each day I graphed the time I spent in this class.	$\bar{X}$	2.65 (1.04)	2.71 (1.14)	2.68 (1.09)	2.29 (1.18)	2.36 (1.22)	2.32 (1.18)
3. I included in my study time total time I spent reading, working problems, outlining, and so on.	$\bar{X}$	3.87 (0.60)	3.89 (0.38)	3.88 (0.39)	3.96 (0.19)	3.80 (0.65)	3.89 (0.47)
4. I excluded class time in my daily totals of study time.	$\bar{X}$	3.87 (0.62)	3.83 (0.64)	3.85 (0.63)	3.96 (0.19)	4.00 (0.00)	3.98 (0.14)
5. I avoided discussions of the project with other classmates.	$\bar{X}$	3.48 (0.75)	3.10 (0.93)	3.28 (0.87)	3.36 (0.73)	3.44 (0.77)	3.40 (0.74)
6. I rated the amount of time I spent on this class with either a + or a - each day.	$\bar{X}$	- -	3.65 (0.79)	3.65 (0.79)	- -	3.83 (0.33)	3.88 (0.33)
7. I recorded the amount of time I studied for this class as soon as I finished studying or at the end of each day.	$\bar{X}$	2.94 (0.65)	2.87 (0.72)	2.90 (0.68)	2.86 (0.76)	2.92 (0.76)	2.89 (0.75)
8. I rated the amount of time I studied for this class when I recorded the amount.	$\bar{X}$	- -	3.67 (0.71)	3.67 (0.71)	- -	3.64 (0.64)	3.64 (0.64)
9. My rating was based on my own opinion of what amount of time was adequate for the day.	$\bar{X}$	- -	3.69 (0.61)	3.69 (0.61)	- -	3.76 (0.72)	3.76 (0.72)
10. I encouraged other students in my class who were not assigned the project to try graphing their study time.	$\bar{X}$	3.67 (0.73)	3.85 (0.42)	3.77 (0.59)	3.82 (0.55)	3.84 (0.62)	3.83 (0.58)
11. I also encouraged other students not assigned the project to rate their study time.	$\bar{X}$	- -	3.92 (0.27)	3.92 (0.27)	- -	3.84 (0.62)	3.84 (0.62)
12. My record of time studied was honest.	$\bar{X}$	3.76 (0.43)	3.73 (0.45)	3.75 (0.44)	3.75 (0.44)	3.80 (0.41)	3.77 (0.42)
13. When I didn't study on a given day I recorded 0 in the daily study time log.	$\bar{X}$	4.00 (0.00)	3.96 (0.19)	3.98 (0.14)	4.00 (0.00)	4.00 (0.00)	4.00 (0.00)
14. I believe I studied more for this class as a result of this project.	$\bar{X}$	1.96 (0.76)	1.92 (0.74)	1.94 (0.74)	1.79 (0.69)	2.12 (0.73)	1.94 (0.72)
15. I will continue to record and graph my study time in this class.	$\bar{X}$	1.87 (0.75)	1.77 (0.70)	1.82 (0.72)	1.71 (0.54)	2.00 (0.58)	1.85 (0.57)
16. I will try recording and graphing my study time in other classes.	$\bar{X}$	1.78 (0.59)	1.77 (0.68)	1.78 (0.64)	1.93 (0.66)	1.96 (0.54)	1.94 (0.60)

Note. The n's are as follows: Chemistry, SM = 46, SM+C = 52; Calculus, SM = 28; SM+C = 25. The n for the total for a given item depends on the number of the experimental conditions that included the item.

[a]Standard deviations are enclosed in parentheses.

were as follows: chemistry SM = 3.49 (0.29) and SM+C = 3.56 (0.27); calculus SM = 3.48 (0.31) and SM+C = 3.58 (0.27).

Correlations between Reported Study Time and Midterm II

Correlations were computed between average reported study time and grade on midterm II in chemistry r = -.033, n = 98; in calculus, r = .004, n = 53. There were no significant correlations.

Discussion

Academic Performance

With regard to academic performance, conflicting results from the two classes indicate only partial support for the notion that students who utilized self-control techniques would evidence superior test performance relative to controls. This was true in chemistry but not in calculus. Conversely, the findings do not indicate that the SM+C subjects outperformed the SM subjects. In chemistry, the students who simply monitored their study time (SM) evidenced slightly higher scores than those who monitored and used an overt self-rating procedure (SM+C). In calculus, the opposite finding was obtained. In both cases, however, the results do not depart significantly from results that could be obtained by chance. Based on examination of average study times, it would appear that these courses differed in the amount of time required.

It is plausible that there are characteristics of various university courses or subject matter areas that interact with self-control techniques, such as difficulty level, imposed structure, attendance requirements, class size and concomitant

demands for participation, and type of academic product required. For example, courses with a lower difficulty level could make the use of self-control techniques such as self-monitoring and self-rating superfluous because the course required little effort from a particular student or group of students. Or, a course could be so structured, including daily or weekly quizzes, that the effects of self-control techniques, designed to keep a student up to date in a class, would be unnecessary. The external structure and demands would be serving this purpose. It appears that the differential effectiveness of self-control techniques in different types of courses needs further investigation.

It is clear that the addition of self-reinforcement and self-punishment in the form of self-ratings did not enhance the self-monitoring effect when it occurred. This finding is in counterdistinction to Bellack (1976) who asserts that "the explicit use of SR [self-reinforcement] critically augments whatever effects SM [self-monitoring] has." It is important to recognize, however, that self-rating, the particular operation definition selected for the self-reinforcement/self-punishment combination, is a symbolic, as opposed to tangible, reinforcer. Perhaps there <u>are</u> differences in the effectiveness of symbolic and tangible reinforcers that interact with a variety of characteristics of the subject, setting, or dependent variable. Such differences could account for the failure of the self-reinforcement/self-punishment procedure to augment the self-monitoring effect.

The failure to find differences between the SM and SM+C conditions may be a success in finding similarities. That is, it seems that the overt self-reinforcement/self-punishment procedures used in the SM+C condition do not differ significantly from self-monitoring procedures and their presumed implicit self-rating components. These self-rating procedures were selected because they most closely approximate the internal evaluation process suspected in self-monitoring. This finding lends some support to the contention that self-monitoring effects result from more than merely recording behavior. Such effects could be due to a covert self-reinforcement/punishment process, much like that of self-rating.

Reported Study Time

The conflicting results obtained between the two classes with regard to academic performance take on a new look when the reported study times for each class are examined. It would appear that the two classes differed markedly in difficulty level or amount of studying necessary. Clearly, students in the chemistry class began the experimental period with a much higher average daily study time relative to calculus students (2.5 times). (It should be remembered that the first week of the experimental period was actually the fourth week of the course. It was also the week immediately following the first midterm exam.) By the third week, their average daily reported study time was 4.2 times higher than that of

calculus students. Chemistry students were averaging approximately 2.5 hours a day, seven days a week. The study times reported by calculus students were never very high; neither did they increase very much even when a midterm exam was pending. Conversely, chemistry students' average times were quite high and their increases were dramatic.

It is very possible that self-control techniques have little impact on a situation in which minimal self-control is required to obtain the desired results. If students have discerned that only a small amount of effort is required to attain their goal, which may be either a grade or knowledge of the subject matter, there is little more for self-control techniques to accomplish. Some of the conflicting results in self-control applications could be due to such uncontrolled effects of course or task difficulty level. These factors are deserving of further investigation.

Self-rating of Study Time

The self-ratings provided by the SM+C condition in both classes also provide valuable information and assistance in accounting for the discrepancies between the two experiments. Interestingly, comparison of the self-ratings from each class indicated that students in chemistry only rated their study time positively about 26% of the time. Furthermore, they gave such self-ratings largely during the week they were studying approximately 2.5 hours a day. Calculus students rated study time positively for the first week when it was approximately 17 minutes a day as well as when it was averaging 37 minutes

a day during the third week. They rated study time positively about 48% of the time. These observations give further support to the notion that students in calculus simply required far less study time than their counterparts in chemistry in order to complete the course or meet self-established performance criteria.

Questionnaire Responses

The questionnaire was designed primarily to provide an independent opportunity to determine whether students in the experimental conditions followed their instructions. Overall, students indicated a high level of conformity, averaging about 3.5 to a 3.6 on a 4.00 scale. There were no significant differences between the two conditions within a class; neither were there any significant differences between the two classes. This is an important finding. The failure to obtain effects for the self-control techniques in calculus cannot be attributed to any difference in conformity to instructions between the two classes.

Two of the items designed to assess conformity to instructions provide some insight about the accuracy of the self-report measure. Item 18 stated "my record of study time was honest." Responses to this item averaged to be about 3.75 which is a midpoint between "usually" and "always" on the scale. A related item, number 14, stated "when I didn't study on a given day, I recorded 0 in the daily study time log."

Responses averaged 3.98 and 4.00 for chemistry and calculus respectively. Thus, it appears reasonable to conclude that the reported study times were accurate and honest. Otherwise, one would be required to conclude that there was tremendous conformity among subjects in a lying behavior.

Study Time and Test Performance Correlations

The zero order correlations in both classes between performance on midterm II and an individual's average study time seem reasonable in that the study time required to attain a particular level of performance would vary with the ability and background of each student. The precise way in which self-monitoring and self-rating of study time actually affects academic performance is not clear. This issue will be discussed further in the section on the monitored behavior.

A very few students did indicate that they believed the procedures increased their study time. Such comments were made in the open-ended section of the questionnaire and to the experimenter in conversation. One calculus student remarked that it was one thing to know she wasn't studying very much, and quite another to have that fact staring at her on a piece of paper. However, such comments were few in number.

The Monitored Behavior

Self-control investigations on academic performance are typically arranged so that a particular behavior with a presumed relationship to academic performance is monitored. Study time, disruptive behavior, or number of pages read are

three examples of behaviors that are monitored, followed by assessments of academic performance. In the larger field of self-control investigations, the monitored behavior is often the actual dependent variable of interest (i.e., nailbiting, hallucinating, smoking). The dependent variable is monitored directly in such cases. Weight control studies provide a good example of both methods. In some studies, subjects monitor eating behavior or calorie intake, however, the dependent variable of interest is actually weight loss. Such studies can also be designed so that weight is the actual behavior monitored (i.e., daily weight charts).

Similarly, studies on academic performance can be designed whereby the dependent variable and the behavior to be monitored are the same. For example, 2nd graders monitor the number of correct arithmetic problems completed each day, rather than monitoring the amount of time spent on arithmetic, and subsequently examining arithmetic performance. This is an important distinction because the effects of monitoring a behavior assumed to influence another behavior is dependent on the correctness of such an assumption and the strength of the relationship.

The present investigation is one in which the actual behavior monitored (study time) was not the primary dependent variable of interest (academic performance). Obviously, there are settings in which such a procedure is preferable or the only option available. Academic performance is assessed far too infrequently in most college classes to be used as the monitored behavior. However, it will be important for

future self-control studies to examine whether differential effects are obtained as a result of a distinction between directly monitoring and consequating the particular dependent variable of interest versus one with a presumed relationship to this variable.

Proportion of Self-reinforcement and Self-punishment

In general, punishment techniques are regarded as inferior to reinforcement procedures in obtaining behavior change, despite a great deal of evidence to the contrary. In examining the self-ratings of study time, it is interesting to note the preponderance of negative ratings in chemistry. For this class, then, the amount of self-punishment, operationalized as a negative self-rating, was three times the amount of self-reward. Conversely, in calculus the amount of self-reinforcement and self-punishment was approximately equal. Chemistry students administered self-punishment approximately 74% of the time, whereas, calculus students administered self-punishment approximately 52% of the time.

It would appear that a combination of self-reinforcement and self-punishment was effective when the proportion of self-punishment was high. This finding casts some doubt on the notion that self-punishment is an inferior behavior change technique. Future studies would do well to consider the reciprocal nature of the self-punishment/reinforcement contingency and examine the overall amount of reinforcement and punishment present in any experimental period.

Recommendations

In the present investigation, some question has been raised about the relative strength of covert and overt symbolic reinforcement/punishment processes. The similarities between the effects of the SM and SM+C condition indicate that the addition of overt symbolic reinforcement/punishment process, in this instance, did not enhance self-monitoring effects which appear to result from similar processes that are covert. Yet, prior studies have indicated that reinforcement does augment the self-monitoring effect. Investigations aimed at isolating the self-monitoring effect should be undertaken using covert symbolic, overt symbolic, and overt tangible reinforcers as well as control groups for comparison.

Self-reinforcement and self-punishment should be conceptualized as integrally related processes. Assessments of the proportion of self-reinforcement and self-punishment in a given investigation should be made. Attempts to determine the most efficacious proportions should be undertaken.

Furthermore, careful attention should be paid to the actual behavior that is being monitored. Future studies should focus on the relative effectiveness of monitoring the behavior to be increased versus the behavior to be decreased. And, investigations should seek to determine whether direct monitoring and consequating of the primary dependent variable is superior to monitoring a presumably

related behavior. Then, when possible, the preferable technique could be utilized.

Efforts should be made to isolate the factor influencing academic performance when study time is the behavior actually monitored. Academic performance-study time correlations are often small and rarely significant, thus, it is important to determine what the active ingredient is in monitoring study time that contributes to improvement in academic performance. Where possible, comparisons should be undertaken to determine whether conditions like SM and SM+C actually result in increased study time. Such a study would probably have to be conducted in a supervised setting in which unobtrusive assessment of a control group's study time could be made.

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